

## CHAPTER 26

# Marginal Costing and Cost Volume Profit Analysis

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### Meaning

**Marginal Cost:** The term Marginal Cost refers to the amount at any given volume of output by which the aggregate costs are charged if the volume of output is changed by one unit. Accordingly, it means that the added or additional cost of an extra unit of output.

Marginal cost may also be defined as the “cost of producing one additional unit of product.” Thus, the concept marginal cost indicates wherever there is a change in the volume of output, certainly there will be some change in the total cost. It is concerned with the changes in variable costs. Fixed cost is treated as a period cost and is transferred to Profit and Loss Account.

**Marginal Costing:** Marginal Costing may be defined as “the ascertainment by differentiating between fixed cost and variable cost, of marginal cost and of the effect on profit of changes in volume or type of output.” With marginal costing procedure costs are separated into fixed and variable cost.

According to J. Batty, Marginal costing is “a technique of cost accounting pays special attention to the behaviour of costs with changes in the volume of output.” This definition lays emphasis on the ascertainment of marginal costs and also the effect of changes in volume or type of output on the company’s profit.

### FEATURES OF MARGINAL COSTING

- (1) All elements of costs are classified into fixed and variable costs.
- (2) Marginal costing is a technique of cost control and decision making.
- (3) Variable costs are charged as the cost of production.
- (4) Valuation of stock of work in progress and finished goods is done on the basis of variable costs.
- (5) Profit is calculated by deducting the fixed cost from the contribution, i.e., excess of selling price over marginal cost of sales.
- (6) Profitability of various levels of activity is determined by cost volume profit analysis.

## Absorption Costing

Absorption costing is also termed as Full Costing or Total Costing or Conventional Costing. It is a technique of cost ascertainment. Under this method both fixed and variable costs are charged to product or process or operation. Accordingly, the cost of the product is determined after considering both fixed and variable costs.

**Absorption Costing Vs Marginal Costing :** The following are the important differences between Absorption Costing and Marginal Costing :

- (1) Under Absorption Costing all fixed and variable costs are recovered from production while under Marginal Costing only variable costs are charged to production.
- (2) Under Absorption Costing valuation of stock of work in progress and finished goods is done on the basis of total costs of both fixed cost and variable cost. While in Marginal Costing valuation of stock of work in progress and finished goods at total variable cost only.
- (3) Absorption Costing focuses its attention on long-term decision making while under Marginal Costing guidance for short-term decision making.
- (4) Absorption Costing lays emphasis on production, operation or process while Marginal Costing focuses on selling and pricing aspects.

## Differential Costing

Differential Costing is also termed as Relevant Costing or Incremental Analysis. Differential Costing is a technique useful for cost control and decision making.

According to ICMA London differential costing “is a technique based on preparation of adhoc information in which only cost and income differences between two alternatives / courses of actions are taken into consideration.”

**Marginal Costing and Differential Costing :** The following are the differences between Marginal Costing and Differential Costing :

- (1) Differential Costing can be made in the case of both Absorption Costing as well as Marginal Costing
- (2) While Marginal Costing excludes the entire fixed cost, some of the fixed costs may be taken into account as being relevant for the purpose of Differential Cost Analysis.
- (3) Marginal Costing may be embodied in the accounting system whereas Differential Cost are worked separately as analysis statements.
- (4) In Marginal costing, margin of contribution and contribution ratios are the main yardstick for the performance evaluation and for decision making. In Differential Cost Analysis, differential costs are compared with the incremental or decremental revenues as the case may be.

## Advantages of Marginal Costing (or)

### Important Decision Making Areas of Marginal Costing

The following are the important decision making areas where marginal costing technique is used :

- (1) Pricing decisions in special circumstances :
  - (a) Pricing in periods of recession;
  - (b) Use of differential selling prices.

- (2) Acceptance of offer and submission of tenders.
- (3) Make or buy decisions.
- (4) Shutdown or continue decisions or alternative use of production facilities.
- (5) Retain or replace a machine.
- (6) Decisions as to whether to sell in the export market or in the home market.
- (7) Change Vs status quo.
- (8) Whether to expand or contract.
- (9) Product mix decisions like for example :
  - (a) Selection of optimal product mix;
  - (b) Product substitution;
  - (c) Product discontinuance.
- (10) Break-Even Analysis.

### **Limitations of Marginal Costing**

- (1) It may be very difficult to segregation of all costs into fixed and variable costs.
- (2) Marginal Costing technique cannot be suitable for all type of industries. For example, it is difficult to apply in ship-building, contract industries etc.
- (3) The elimination of fixed overheads leads to difficulty in determination of selling price.
- (4) It assumes that the fixed costs are controllable, but in the long run all costs are variable.
- (5) Marginal Costing does not provide any standard for the evaluation of performance which is provided by standard costing and budgetary control.
- (6) With the development of advanced technology fixed expenses are proportionally increased. Therefore, the exclusion of fixed cost is less effective.
- (7) Under marginal costing elimination of fixed costs results in the under valuation of stock of work in progress and finished goods. It will reflect in true profit.
- (8) Marginal Costing focuses its attention on sales aspect. Accordingly, contribution and profits are determined on the basis of sales volume. It does not consider other functional aspects.
- (9) Under Marginal Costing semi variable and semi fixed costs cannot be segregated accurately.

### **COST VOLUME PROFIT ANALYSIS**

Cost Volume Profit Analysis (C V P) is a systematic method of examining the relationship between changes in the volume of output and changes in total sales revenue, expenses (costs) and net profit. In other words, it is the analysis of the relationship existing amongst costs, sales revenues, output and the resultant profit.

To know the cost, volume and profit relationship, a study of the following is essential :

- (1) Marginal Cost Formula
- (2) Break-Even Analysis

- (3) Profit Volume Ratio (or) P/V Ratio
- (4) Profit Graph
- (5) Key Factors and
- (6) Sales Mix

### Objectives of Cost Volume Profit Analysis

The following are the important objectives of cost volume profit analysis :

- (1) Cost volume is a powerful tool for decision making.
- (2) It makes use of the principles of Marginal Costing.
- (3) It enables the management to establish what will happen to the financial results if a specified level of activity or volume fluctuates.
- (4) It helps in the determination of break-even point and the level of output required to earn a desired profit.
- (5) The P/V ratio serves as a measure of efficiency of each product, factory, sales area etc. and thus helps the management to choose a most profitable line of business.
- (6) It helps us to forecast the level of sales required to maintain a given amount of profit at different levels of prices.

### Marginal Cost Equation

The Following are the main important equations of Marginal Cost :

$$\text{Sales} = \text{Variable Cost} + \text{Fixed Expenses} \pm \text{Profit / Loss}$$

(or)

$$\text{Sales} - \text{Variable Cost} = \text{Fixed Cost} \pm \text{Profit or Loss}$$

(or)

$$\text{Sales} - \text{Variable Cost} = \text{Contribution}$$

$$\text{Contribution} = \text{Fixed Cost} + \text{Profit}$$

The above equation brings the fact that in order to earn profit the contribution must be more than fixed expenses. To avoid any loss, the contribution must be equal to fixed cost.

### Contribution

The term Contribution refers to the difference between Sales and Marginal Cost of Sales. It also termed as "Gross Margin." Contribution enables to meet fixed costs and profit. Thus, contribution will first covered fixed cost and then the balance amount is added to Net profit. Contribution can be represented as :

$$\text{Contribution} = \text{Sales} - \text{Marginal Cost}$$

$$\text{Contribution} = \text{Sales} - \text{Variable Cost}$$

$$\text{Contribution} = \text{Fixed Expenses} + \text{Profit}$$

$$\text{Contribution} - \text{Fixed Expenses} = \text{Profit}$$

$$\text{Sales} - \text{Variable Cost} = \text{Fixed Cost} + \text{Profit}$$

(or)

$$C = S - V. C$$

$$C = F. C + P$$

$$S - V. C = F. C + P$$

$$C - F. C = P$$

Where :

C = Contribution

S = Sales

F = Fixed Cost

P = Profit

V = Variable Cost

**Illustration: 1**

From the following information, calculate the amount of profit using marginal cost technique :

Fixed cost Rs. 3,00,000

Variable cost per unit Rs. 5

Selling price per unit Rs. 10

Output level 1,00,000 units

**Solution:**

|              |   |                                  |
|--------------|---|----------------------------------|
| Contribution | = | Selling Price – Marginal Cost    |
|              | = | (1,00,000 x 10) – (1,00,000 x 5) |
|              | = | 10,00,000 – 5,00,000             |
|              | = | Rs.5,00,000                      |
| Contribution | = | Fixed Cost + Profit              |
| Rs. 5,00,000 | = | 3,00,000 + Profit                |
| Profit       | = | Contribution – Fixed Cost        |
| Profit       | = | Rs. 5,00,000 – Rs. 3,00,000      |
|              | = | Rs. 2,00,000                     |

**Break-Even Analysis:**

Break-Even Analysis is also called Cost Volume Profit Analysis. The term Break-Even Analysis is used to measure inter relationship between costs, volume and profit at various level of activity. A concern is said to break-even when its total sales are equal to its total costs. It is a point of no profit no loss. This is a point where contribution is equal to fixed cost. In other words, the break-even point where income is equal to expenditure (or) total sales equal to total cost.

The break-even point can be calculated by the following formula :

**Break-Even Point in Units**

|                               |   |   |
|-------------------------------|---|---|
| (1) Break-Even Point in Units | = | $\frac{\text{Total Fixed Cost}}{\text{Contribution per unit}}$  |
| (or) B E P (in units)         | = | $\frac{F}{C}$   |
| (2) Break-Even Point in Units | = | $\frac{\text{Total Fixed Cost}}{\text{Selling Price – Variable Cost}} \\ \text{Per unit} \quad \quad \text{Per unit}$ |

**Break-Even Point in Sales Volume**

$$\begin{aligned}
 (1) \text{ Break-Even Sales} &= \frac{\text{Fixed Cost} \times \text{Sales}}{\text{Sales} - \text{Variable Cost}} \\
 &\quad (\text{or}) \\
 &= \frac{F \times S}{S - V}
 \end{aligned}$$

$$\begin{aligned}
 (2) \text{ Break-Even Sales} &= \frac{\text{Fixed Cost}}{1 - \frac{\text{Variable Cost}}{\text{Sales}}} \\
 &\quad (\text{or}) \\
 &= \frac{F}{1 - \frac{V}{S}}
 \end{aligned}$$

$$(3) \text{ Break-Even Sales} = \frac{\text{Fixed Cost}}{P / V \text{ Ratio}}$$

$$\text{Profit Volume Ratio (P / V ratio)} = \frac{\text{Contribution}}{\text{Sales}} \times 100$$

**Illustration: 2**

From the following particulars find out break-even point :

Fixed Expenses Rs. 1,00,000

Selling price Per unit Rs. 20

Variable cost per unit Rs. 15

**Solution:**

$$\begin{aligned}
 \text{Break-Even Point in Units} &= \frac{\text{Fixed Cost}}{\text{Contribution per unit}} \\
 \text{Contribution per unit} &= \text{Selling Price per unit} - \text{Variable Cost per unit} \\
 &= \text{Rs. 20} - \text{Rs. 15} = \text{Rs. 5} \\
 \text{B E P (in units)} &= \frac{\text{Rs. 1,00,000}}{5} \\
 &= 20,000 \text{ units} \\
 \text{B E P in Sales} &= 20,000 \times \text{Rs. 20} = \text{Rs. 4,00,000}
 \end{aligned}$$

**Profit Volume Ratio (P / V Ratio)**

Profit Volume Ratio is also called as Contribution Sales Ratio (or) Marginal Income Ratio (or) Variable Profit Ratio. It is used to measure the relationship of contribution, the relative profitability of different products, processes or departments.

The following formula for calculating the P / V ratio is given below :

$$(1) \text{ P / V Ratio} = \frac{\text{Contribution}}{\text{Sales}} \quad (\text{or}) \quad \frac{C}{S} \times 100$$

$$(2) \text{ P / V Ratio} = \frac{\text{Sales} - \text{Variable Cost}}{\text{Sales}} \times 100 \quad (\text{or}) \quad \frac{S - V}{S} \times 100$$

$$(3) \text{ P / V Ratio} = \frac{\text{Fixed Cost} + \text{Profit}}{\text{Sales}} \times 100 \quad (\text{or}) \quad \frac{F + P}{S} \times 100$$

When we find out the P / V Ratio, Break-Even Point can be calculated by the following formula :

$$(a) \text{ B E P (Sales volume)} = \frac{\text{Fixed Cost}}{\text{P / V Ratio}}$$

$$(b) \text{ Fixed Cost} = \text{B E P} \times \text{P / V Ratio}$$

(c) Sales required in units to maintain a desired profit :

$$\begin{aligned} &= \frac{\text{Fixed Cost} + \text{Desired Profit}}{\text{P / V Ratio}} \\ (\text{or}) &= \frac{F + P}{\text{P / V Ratio}} \\ (\text{or}) &= \frac{\text{Required Contribution}}{\text{New Contribution per unit}} \end{aligned}$$

$$(d) \text{ Contribution} = \text{Sales} \times \text{P / V Ratio}$$

$$(e) \text{ Variable Cost} = \text{Sales} (1 - \text{P / V Ratio})$$

### Illustration: 3

From the following information calculate :

- (1) P / V Ratio
- (2) Break-Even Point
- (3) If the selling price is reduced to Rs. 80, calculate New Break-Even Point :

|                        |              |
|------------------------|--------------|
| Total sales            | Rs. 5,00,000 |
| Selling price per unit | Rs. 100      |
| Variable cost per unit | Rs. 60       |
| Fixed cost             | Rs. 1,20,000 |

### Solution:

$$(1) \text{ P / V Ratio} = \frac{\text{Contribution}}{\text{Sales}} \times 100$$

$$\begin{aligned} \text{Contribution} &= \text{Sales} - \text{Variable Cost} \\ \text{Total Sales} &= \text{Rs. 5,00,000} \\ \text{Selling price per unit} &= \text{Rs. 100} \end{aligned}$$

$$\begin{aligned}
 \text{Sales in units} &= \frac{5,00,000}{100} = 5000 \text{ units} \\
 \text{Contribution} &= \text{Rs. } 5,00,000 - (5000 \times 60) \\
 &= \text{Rs. } 5,00,000 - \text{Rs. } 3,00,000 = \text{Rs. } 2,00,000 \\
 \text{P / V Ratio} &= \frac{\text{Rs. } 2,00,000}{\text{Rs. } 5,00,000} \times 100 = 40\%
 \end{aligned}$$

$$\begin{aligned}
 (2) \text{ Break-Even Point in sales} &= \frac{\text{Fixed Cost}}{\text{P / V Ratio}} \\
 &= \frac{\text{Rs. } 1,20,000}{40\%} = \frac{1,20,000}{40} \times 100 \\
 &= \frac{1,20,000}{40} \times 100 \\
 &= \text{Rs. } 3,00,000
 \end{aligned}$$

(3) If the Selling price is reduced to Rs. 80 :

$$\begin{aligned}
 \text{Sales} &= \frac{5,00,000}{100} \times 80 \\
 &= \text{Rs. } 4,00,000 \\
 \text{Break-Even Point (in units)} &= \frac{\text{Fixed Cost}}{\text{Contribution per unit}} \\
 &\quad \text{(or)} \\
 &= \frac{\text{Fixed Cost}}{\text{Selling Price} - \text{Variable Cost}} \\
 &= \frac{\text{Rs. } 1,20,000}{80 - 50} = \frac{1,20,000}{30} = 4,000 \text{ units} \\
 \text{Break-Even Point in Sales} &= 4,000 \text{ units} \times \text{Rs. } 80 \\
 &= \text{Rs. } 3,20,000
 \end{aligned}$$

#### Illustration: 4

Sales Rs. 2,00,000  
 Profit Rs. 20,000  
 Variable Cost 60%

You are required to calculate :

- (1) P / V Ratio
- (2) Fixed Cost
- (3) Sales volume to earn a profit of Rs. 50,000

#### Solution:

$$\begin{aligned}
 \text{Sales} &= \text{Rs. } 2,00,000 \\
 \text{Variable Cost} &= 60\% \\
 &= \frac{60}{100} \times 2,00,000
 \end{aligned}$$

$$\begin{aligned}
 &= \text{Rs. } 1,20,000 \\
 (1) \text{ P / V Ratio} &= \frac{\text{Sales} - \text{Variable Cost}}{\text{Sales}} \times 100 \\
 &= \frac{2,00,000 - 1,20,000}{2,00,000} \times 100 \\
 &= \frac{80,000}{2,00,000} \times 100 = 40\% \\
 (2) \text{ Contribution} &= \text{Fixed Cost} + \text{Profit} \\
 &\quad (\text{or}) \\
 \text{Contribution} &= \text{Sales} - \text{Variable Cost} \\
 &= \text{Rs. } 2,00,000 - \text{Rs. } 1,20,000 = \text{Rs. } 80,000 \\
 \text{Contribution} &= \text{Fixed Cost} + \text{Profit} \\
 80,000 &= \text{Fixed Cost} + \text{Rs. } 20,000 \\
 \text{Fixed Cost} &= \text{Rs. } 80,000 - \text{Rs. } 20,000 = \text{Rs. } 60,000
 \end{aligned}$$

(3) Sales volume to earn a profit of Rs. 50,000

$$\begin{aligned}
 \text{Sales} &= \frac{\text{Fixed Cost} + \text{Desired Profit}}{\text{P / V Ratio}} \\
 &= \frac{\text{Rs. } 60,000 + \text{Rs. } 50,000}{40\%} \\
 &= \frac{\text{Rs. } 1,10,000}{\frac{40}{100}} = \frac{\text{Rs. } 1,10,000}{40} \times 100 \\
 &= \text{Rs. } 2,75,000
 \end{aligned}$$

### Illustration: 5

From the following particulars, calculate :

- (a) P / V Ratio
  - (b) Profit when sales are Rs. 40,000, and
  - (c) New break-even point if selling price is reduced by 10%
- Fixed cost = Rs. 8,000  
 Break-even point = Rs. 20,000  
 Variable cost = Rs. 60 per unit

### Solution:

$$\begin{aligned}
 (a) \text{ Break-Even Point} &= \frac{\text{Fixed Cost}}{\text{P / V Ratio}} \\
 \therefore \text{ P / V Ratio} &= \frac{\text{Fixed Cost}}{\text{Break-Even Point}} \\
 &= \frac{8,000}{20,000} \times 100 = 40\%
 \end{aligned}$$

(b) Profit when sales are Rs. 40,000

$$\begin{aligned}
 \text{Profit} &= \text{Sales} \times P / V \text{ Ratio} - \text{Fixed Cost} \\
 &= \text{Rs. } 40,000 \times 40\% - \text{Rs. } 8,000 \\
 &= \text{Rs. } 16,000 - \text{Rs. } 8,000 = \text{Rs. } 8,000
 \end{aligned}$$

(c) New break-even point if the selling price is reduced by 10%. If the selling price is Rs. 100, now it is reduced by 10%, i.e., it will be Rs. 90 (100 – 10)

$$\begin{aligned}
 \text{Variable Cost} &= \text{Rs. } 60 \text{ Per unit} \\
 \text{New P / V Ratio} &= \frac{\text{Selling Price} - \text{Variable Cost}}{\text{Selling Price}} \times 100 \\
 &= \frac{90 - 60}{90} \times 100 = 33.33\%
 \end{aligned}$$

$$\begin{aligned}
 \text{New Break-Even Point} &= \frac{\text{Fixed Cost}}{\text{New P / V Ratio}} \\
 &= \frac{8,000}{33.33\%} = \text{Rs. } 24,002.40
 \end{aligned}$$

$$\text{New Break-Even Point} = \text{Rs. } 24,002.40$$

#### Illustration: 6

MNP Ltd. produces a chocolate almond bar. Each bar sells for Rs. 20. The variable cost for each bar (sugar, chocolate, almonds, wrapper, labour) total Rs. 12.50. The total fixed cost are Rs. 30,00,000. During the year, 10,00,000 bars were sold. The CEO of MNP Ltd. not fully satisfied with the profit performance of chocolate bar, was considering the following options to increase the profitability :

- (I) Increase advertising
- (II) Improve the quality of ingredients and, simultaneously, increase the selling price
- (III) Increase the selling price
- (IV) Combination of three.

#### Required

- (1) The sales manager is confident that an advertising campaign could double sales volume. If the company CEO's goal is to increase this year's profits by 50% over last year's, what is the maximum amount that can be spent on advertising.
- (2) Assume that the company improves the quality of its ingredients, thus increasing variable cost to Rs.15. Answer the following questions :
  - (a) How much the selling price be increased to maintain the same break-even point?
  - (b) What will be the new price, if the company wants to increase the old contribution margin ratio by 50%?
- (3) The company has decided to increase its selling price to Rs. 25. The sales volume drops from 10,00,000 to 8,00,000 bars. Was the decision to increase the price a good one? Compute the sales volume that would be needed at the new price for the company to earn the same profit at last year.
- (4) The sales manager is convinced that by improving the quality of ingredients (increasing variable cost to Rs. 15) and by advertising the improved quality (advertisement amount would be increased by Rs. 50,00,000), sales volume could be doubled. He has also indicated that a price increase would not affect the

ability to double sales volume as long as the price increase is not more than 20% of the current selling price. Compute the selling price that would be needed to achieve the goal of increasing profits by 50%. Is the sales manager's plan feasible? What selling price would you choose? Why?

(CA, PE, 2002)

**Solution:**

Contribution Analysis of operating result of a most recent year :

|  |   |
|--|---|
| Selling price  | Rs. 20.00   |
| Less : Variable Cost                                   | Rs. 12.50   |
| Contribution   | Rs. 7.50  |
| For 10,00,000 units x 7.50                             | = Rs. 75,00,000   |
| Less : Fixed Cost                                      | = Rs. 30,00,000   |
| Profit   | = Rs. 45,00,000   |
| (1) Desired Profit                                     | = Rs. 45,00,000 x Rs. 1.50  |
|  | = Rs. 67,50,000   |
| Contribution (Rs.7.50 x 20,00,000 bars )               | = Rs. 1,50,00,000   |
| Less : Desired Operating Profits                       | = Rs. 67,50,000   |
|  | = Rs. 82,50,000   |
| Less : Fixed Cost (other than Incremental Advertising) | = Rs. 30,00,000   |
| Maximum amount that can be spent on Advertisement      | = Rs. 52,50,000   |
| (2) (a) Variable cost increased to                     | = Rs. 15 per bar  |
| Break-Even Point<br>(Most recent year)                 | = $\frac{\text{Fixed Cost}}{\text{Selling Price} - \text{Variable Cost}}$ |
|  | = $\frac{30,00,000}{20 - 12.50} = \frac{30,00,000}{7.50}$                 |
|  | = 4,00,000 bars   |

Let S = Desired Selling Price

|                             |   |
|-----------------------------|---|
| 4,00,000                    | = $\frac{3,00,000}{\text{Sales} - \text{Variable Cost}}$      |
|                             | = $\frac{30,00,000}{S - \text{Rs.15}}$                        |
| 4,00,000                    | = $\frac{30,00,000}{4,00,000} = 7.50 + 15 = \text{Rs. 22.50}$ |
| S                           | = Rs. 22.50   |
| ∴ S                         | = Rs. 22.50   |
| Selling Price, increased by | = $\frac{2.50}{20} \times 100 = 12.50\%$                      |

2. (b) New Price, if Co. wants to increase old contribution margin ratio by 50%

$$\text{Old contribution margin ratio} = \frac{7.50}{20} \times 100 = 37.50\%$$

$$\text{Desired to increase at } 56.25\% = (37.50 + 50\% \text{ of } 37.50)$$

$$\therefore \text{Variable Cost / Sales} = 43.75\%$$

$$\begin{aligned} \text{Hence new Selling Price} &= \frac{\text{Rs. } 15}{0.4375} \\ &= \text{Rs. } 34.2857 \end{aligned}$$

$$\begin{aligned} (3) \text{ New Selling Price} &= \text{Rs. } 25 \\ \text{New sales Volume} &= 8,00,000 \text{ bars} \\ \text{Contribution} &= \text{Sales} - \text{Variable Cost Per unit} \\ &= \text{Rs. } 25 - 12.50 = \text{Rs. } 12.50 \\ \text{Contribution} &= 8,00,000 \times 12.50 \\ &= \text{Rs. } 1,00,00,000 \\ \text{Less : Fixed Cost} &= \text{Rs. } 30,00,000 \\ \text{Operating profit} &= \text{Rs. } 70,00,000 \end{aligned}$$

The decision seems to be good one as operating profit has increased from Rs. 45 lakhs to Rs. 70 lakhs:

$$\begin{aligned} \text{Desired Sales Qty.} &= \frac{\text{Fixed Cost} + \text{Desired Profit}}{\text{Selling Price} - \text{Variable Cost}} \\ &= \frac{\text{Rs. } 30,00,000 + \text{Rs. } 45,00,000}{12 - 12.50} \end{aligned}$$

$$\begin{aligned} &= 6,00,000 \text{ bars.} \\ (4) \text{ Variable cost per bar} &= \text{Rs. } 15 \\ \text{Fixed cost increased due to advertising} &= \text{From Rs. } 30 \text{ lakhs to Rs. } 80 \text{ lakhs} \\ \text{Let desired selling price be} &= S \\ \text{Then desired Selling price needed to achieve profit goals of Rs. } 67,50,000 &= S \end{aligned}$$

$$\begin{aligned} 20,00,000 \text{ bars} &= \frac{\text{Fixed Cost} + \text{Desired Profit}}{S - \text{Variable Cost Per bar}} \\ 20,00,000 &= \frac{\text{Rs. } 80 \text{ lakhs} + \text{Rs. } 67.5 \text{ lakhs}}{S - \text{Rs. } 15} \\ S &= \frac{\text{Rs. } 147.5 \text{ lakhs}}{20,00,000} = \text{Rs. } 7.375 + 15 \\ \therefore S &= \text{Rs. } 22.375 \\ &= \text{Rs. } 22.375 \end{aligned}$$

Yes, Sales manager's plan seems feasible

$$\text{As price increase of} = \frac{2.375}{20} \times 100 = 11.875\% \text{ is required}$$

to achieve desired profit  
but the caveat is :

- (1) Is market so big?
- (2) Will competitors not follow aggressive strategy when it hurts them?

The choice of selling price of Rs. 22.375 depends on the assessment of above two factors.

**Illustration: 7**

A Company manufactures a single product with a capacity of 1,50,000 units per annum. The summarized profitability statement for the year is as under:

|   | Rs.      | Rs.       |
|---|----------|-----------|
| Sales : 1,00,000 units @ Rs.15 per unit |          | 15,00,000 |
| Less : Cost of Sales :                  |          |           |
| Direct Materials                        | 3,00,000 |           |
| Direct Labour                           | 2,00,000 |           |
| Production overhead :                   |          |           |
| Variable                                | 60,000   |           |
| Fixed                                   | 3,00,000 |           |
| Administration Overhead (Fixed)         | 1,50,000 |           |
| Selling and Distribution Overheads :    |          |           |
| Variable                                | 90,000   |           |
| Fixed                                   | 1,50,000 | 12,50,000 |
| Profit                                  |          | 2,50,000  |

You are required to evaluate the following options:

- (1) What will be the amount of sales required to earn a target profit of 25% on sales, if the packing is improved at a cost of Re.1 per unit?
- (2) There is an offer from a large retailer for purchasing 30,000 units per annum, subject to providing a packing with a different brand name at a cost of Rs. 2 per unit. However, in this case there will be no selling and distribution expenses. Also this will not, in any way, affect the company's existing business. What be the break-even price for this additional offer.?
- (3) If an expenditure of Rs. 3,00,000 is made on advertising the sales would increase from the present level of 1,00,000 units to 1,20,000 units at a price of Rs. 18 per unit, will that expenditure be justified?
- (4) If the selling price is reduced by Rs. 2 per unit, there will be 100% capacity utilization. Will the reduction in selling price be justified?

(C A Inter, May 2001)

**Solution:**

|                                    | Method I<br>(Per unit Rs.) | Method II<br>(in total Rs.) |
|------------------------------------|----------------------------|-----------------------------|
| Selling price                      | 15.00                      | 15,00,000                   |
| Less : Variable Cost :             |                            |                             |
| Direct materials                   | 3.00                       | 3,00,000                    |
| Direct Labour                      | 2.00                       | 2,00,000                    |
| Production Overheads               | 0.60                       | 60,000                      |
| Selling Overheads                  | 0.90                       | 90,000                      |
| Total variable Cost                | 6.50                       | 6,50,000                    |
| Contribution (Sales-Variable Cost) | 8.50                       | 8,50,000                    |

**Evaluation of Options****(1) Option I :**

|   | <i>Method I</i><br>(Per unit Rs.) | <i>Method II</i><br>(in total Rs.) |
|---|-----------------------------------|------------------------------------|
| Present Marginal Cost (V. C.)                     | 6.50                              | 6,50,000                           |
| Add : Additional Cost of Packing                  | 1.00                              | 1,00,000                           |
| Revised Contribution<br>(Sales – Variable Cost) } | <u>7.50</u>                       | <u>7,50,000</u>                    |

$$P / V \text{ Ratio} = \frac{\text{Contribution}}{\text{Sales}} \times 100 = \frac{7,50,000}{15,00,000} = 50\% \quad 50\%$$

Let the proposed sales be equal to X

$$\begin{aligned} \text{Sales X} &= \frac{(\text{Fixed Cost} + 25\% \text{ of X})}{50\%} \\ \text{Sales} &= \frac{6,00,000 + 0.25 \text{ X}}{50\%} = \frac{6,00,000 + 0.25 \times 100}{50} \\ &= \text{Rs. 24,00,000} \end{aligned}$$

**Alternative Solution:**

Let the number of units to be sold = X

The equation is :

$$\begin{aligned} \text{Sales} &= \text{Variable Cost} + \text{Fixed Cost} + \text{Profit} \\ 15 \text{ x} &= 7.50 \text{ x} + \text{Rs. 6,00,000} + 3.75 \text{ x} \end{aligned}$$

Transposing and solving we get

$$\begin{aligned} 3.75 \text{ x} &= \text{Rs. 6,00,000} \\ \text{X} &= \frac{6,00,000}{3.75} = 1,60,000 \text{ units} \\ \therefore \text{Sales in units} &= 1,60,000 \text{ units} \\ \text{Sales in volume} &= 1,60,000 \times 15 = \text{Rs. 24,00,000} \end{aligned}$$

**(2) Option II :**

|                                      |   |                 |
|--------------------------------------|---|-----------------|
| Present Marginal Cost                | = | Rs. 6.50        |
| Less : Variable selling Cost         | = | <u>Rs. 0.90</u> |
| Net cost per unit                    | = | Rs. 5.60        |
| Add : Special packing Cost           | = | <u>Rs. 2.00</u> |
| Total Variable Cost per unit         | = | <u>Rs. 7.60</u> |
| Total Variable Cost for 30,000 units | = | 30,000 x 7.60   |
|                                      | = | Rs. 2,28,000    |

There is no impact of this transactions on fixed cost. Hence the price should atleast cover Rs. 2,28,000. Therefore, unit price to break-even is Rs. 760.

**(3) Option III :**

Revised Contribution when selling price is Rs. 18

|                                     |          |                               |
|-------------------------------------|----------|-------------------------------|
| ∴ Contribution                      | =        | Selling Cost – Variable Cost  |
|                                     | =        | Rs. 18 – Rs. 6.50 = Rs. 11.50 |
| Quantum of sales                    | =        | 1,20,000 units                |
| Total contribution 1,20,000 x 11.50 | =        | Rs. 13,80,000                 |
| Less : Fixed Cost : Present         | 6,00,000 | } =                           |
| Additional                          | 3,00,000 |                               |
|                                     |          | Rs. 9,00,000                  |
| Profit                              | =        | <u>Rs. 4,80,000</u>           |

As the profit increases, the proposal is justified.

**(4) Option IV :**

|                                      |               |
|--------------------------------------|---------------|
| Revised price Rs. 15 – 2             | Rs. 13.00     |
| Less : Marginal Cost                 | Rs. 6.50      |
| Contribution (selling costing—V.C.)  | Rs. 6.50      |
| Total constriction at 1,50,000 units |               |
| (1,50,000 x Rs. 6.50)                | Rs. 9,75,000  |
| Less: Fixed Cost                     | Rs. 60,00,000 |
| Profit (contribution – Fixed Cost)   | Rs. 3,75,000  |
| As per problem normal profit is      | Rs. 2,50,000  |
| Revised profit is                    | Rs. 3,75,000  |

Since the profit is increased by (Rs. 3,75,000 – Rs. 2,50,000) Rs. 1,25,000 the proposal is acceptable.

**Illustration: 8**

Fill in the blanks for each of the following independent situation :

|                                     | A          | B          | C            | D          | E          |
|-------------------------------------|------------|------------|--------------|------------|------------|
| Selling Price per unit              | —          | Rs. 50     | Rs. 20       | —          | Rs. 30     |
| Variable Cost as % of Selling Price | 60         | —          | 75           | 75         | —          |
| No. of units sold                   | 10,000     | 4,000      | —            | 6,000      | 5,000      |
| Marginal contribution               | Rs. 20,000 | Rs. 80,000 | —            | Rs. 25,000 | Rs. 50,000 |
| Fixed costs                         | Rs. 12,000 | —          | Rs. 1,20,000 | Rs. 10,000 | —          |
| Profit / Loss                       | —          | 20,000     | Rs. 30,000   | —          | Rs. 15,000 |

**Solution:**

|               |   |   |
|---------------|---|---|
| (A) Profit    | = | Contribution – Fixed costs  |
|               | = | Rs. 20,000 – 12,000 = 8,000   |
| Contribution  | = | 20,000  |
| P / V Ratio   | = | (100 – 60) = 40%  |
| Sales         | = | $\frac{\text{Contribution}}{\text{P / V Ratio}} = \frac{20,000}{40\%} = \text{Rs. } 50,000$ |
| Units Sold    | = | 10,000  |
| Selling Price | = | $\frac{\text{Sales volume}}{\text{Units}} = \frac{50,000}{10,000} = \text{Rs. } 5$          |

$$\begin{aligned} \text{(B) Sales 4000 units X Price Rs.50} &= \text{Rs. 2,00,000} \\ \text{Contribution (S - V.C. = Rs. 2,00,000 - Rs. 1,20,000)} &= \text{Rs. 80,000} \end{aligned}$$

$$\text{Variable Cost (60\% of sales, i.e., } 2,00,000 \times \frac{60}{100} \text{)} = \text{Rs. 1,20,000}$$

$$\text{Fixed Cost (contribution - Profit) Rs. 80,000 - Rs. 20,000} = \text{Rs. 60,000}$$

$$\begin{aligned} \text{(C) Contribution (Fixed cost + Profit) Rs. 1,20,000 + Rs. 30,000} &= \text{Rs. 1,50,000} \\ \text{Contribution per unit 25\% of Rs. 20} &= \text{Rs. 5} \end{aligned}$$

$$\text{No. of units} = \frac{\text{Contribution}}{\text{Contribution per unit}} = \frac{1,50,000}{5} = 30,000 \text{ units.}$$

$$\text{(D) Profit (Contribution - Fixed Cost) } 25,000 - 10,000 = \text{Rs. 15,000}$$

$$\text{P / V Ratio} = (100 - 75) = 25\%$$

$$\begin{aligned} \text{Sales} &= \frac{\text{Contribution}}{\text{P / V Ratio}} = \frac{25,000}{25\%} = \frac{25,000}{25} \times 100 \\ &= \text{Rs. 1,00,000} \end{aligned}$$

$$\text{No. of units} = 6,000 \text{ Units}$$

$$\text{Price per unit} = \frac{\text{Contribution}}{\text{No. of Units}} = \frac{1,00,000}{6,000} = \text{Rs. 16.67}$$

$$\text{(E) Sales 5,000 units x Rs. 30 = Rs. 1,50,000}$$

$$\text{Variable cost (Sales - Contribution) Rs. 1,50,000 - 50,000 = 1,00,000}$$

$$\text{Variable cost as \% of selling price} = \frac{1,00,000}{1,50,000} \times 100 = 66.67\%$$

$$\text{Fixed Cost (Contribution - Profit) = Rs. 50,000 - Rs. 15,000 = Rs. 35,000}$$

**Margin of Safety :** The term Margin of safety refers to the excess of actual sales over the break-even sales. It is known as the Margin of Safety. Margin of safety can also be expressed as a percentage of sales. Margin of safety can be improved by :

- (a) Increasing the selling price
- (b) Reducing the variable cost
- (c) Selecting a product mix of larger P/V ratio items
- (d) Reducing fixed costs
- (e) Increasing the output

**Margin of Safety can be calculated by the following formula :**

$$\text{(1) Margin of Safety} = \text{Total Sales - Break-Even Sales}$$

$$\text{(2) Margin of Safety} = \frac{\text{Profit}}{\text{P / V Ratio}}$$

$$\text{(3) Margin of Safety} = \frac{\text{Profit}}{\text{Contribution}} \times \text{Sales}$$

$$\text{(4) Profit} = \text{Margin of Safety} \times \text{P / V ratio}$$

(5) Margin of Safety expressed as percentage:

$$\begin{aligned} \text{Margin of Safety} &= \frac{\text{Margin of Safety}}{\text{Total Sales}} \times 100 \\ &\text{(or)} \\ &= \frac{\text{Actual Sales} - \text{Break-Even Sales}}{\text{Total Sales}} \times 100 \end{aligned}$$

### Illustration: 9

From the following particulars, calculate Margin of safety :

|               |              |
|---------------|--------------|
| Fixed cost    | Rs. 1,00,000 |
| Variable cost | Rs. 1,50,000 |
| Total Sales   | Rs. 3,00,000 |

### Solution:

$$\begin{aligned} \text{Margin of Safety} &= \frac{\text{Profit}}{\text{P / V Ratio}} \\ &\text{(or)} \\ &= \frac{\text{Actual Sales} - \text{Break-Even Sales}}{\text{Sales}} \times 100 \\ \text{P / V Ratio} &= \frac{\text{Sales} - \text{Variable Cost}}{\text{Sales}} \times 100 \\ &= \frac{3,00,000 - 1,50,000}{3,00,000} \times 100 = \frac{1,50,000}{3,00,000} \times 100 \\ &= 50\% \\ \text{P / V Ratio} &= 50\% \\ \text{Break-Even Sales} &= \frac{\text{Fixed Cost}}{\text{P / V Ratio}} = \frac{\text{Rs. 1,00,000}}{50\%} \\ &= \frac{1,00,000}{50} \times 100 = \text{Rs. 2,00,000} \\ \text{Margin of Safety} &= \text{Actual Sales} - \text{Break-Even Sales} \\ &= \text{Rs. 3,00,000} - \text{Rs. 2,00,000} = \text{Rs. 1,00,000} \end{aligned}$$

### Alternatively :

$$\begin{aligned} \text{Contribution} &= \text{Sales} - \text{Variable Cost} \\ &= \text{Rs. 3,00,000} - 1,50,000 = \text{Rs. 1,50,000} \\ \text{Profit} &= \text{Contribution} - \text{Fixed Cost} \\ &= \text{Rs. 1,50,000} - 1,00,000 = \text{Rs. 50,000} \\ \text{Margin of Safety} &= \frac{\text{Profit}}{\text{P / V Ratio}} = \frac{50,000}{50\%} \\ &= \frac{50,000}{50} \times 100 = \text{Rs. 1,00,000} \end{aligned}$$

**Margin of Safety expressed in percentage of sales :**

$$\begin{aligned}
 &= \frac{\text{Margin of Safety}}{\text{Actual Sales}} \times 100 \\
 &= \frac{\text{Rs.1,00,000}}{\text{Rs.3,00,000}} \times 100 \\
 &= 33.33\%
 \end{aligned}$$

**Illustration: 10**

A company manufactures a product, currently utilizing 80% capacity with a turnover of Rs. 8,00,000 at Rs.25 per unit. The cost data are as under :

Material Cost Rs. 7.50 per unit, Labour Cost Rs. 6.25 per unit. Semi-Variable Cost (including variable cost of Rs. 3.75 per unit) Rs. 1,80,000.

Fixed Cost Rs. 90,000 upto 80% level of output, beyond this an additional Rs. 20,000 will be incurred.

**Calculate:**

- (1) Activity level at Break-Even Point.
- (2) Number of units to be sold to earn a net income of 8% of sales.
- (3) Activity level needed to earn a profit of Rs. 95,000.
- (4) What should be the selling price per unit, if break-even point is to be brought down to 40% activity level?

(C A. Inter, Nov. 2000)

**Solution:****Working Notes :****(a) Variable cost per unit :**

|                             | Rs.            |
|-----------------------------|----------------|
| Material cost per unit      | = 7.50         |
| Labour cost per unit        | = 6.25         |
| Semi Variable cost per unit | = 3.75         |
| Variable Cost per unit      | = <u>17.50</u> |

**(b) Contribution per unit :**

|                       |   |
|-----------------------|---|
| Contribution per unit | = Selling price per unit – Variable cost per unit |
|                       | = Rs. 25 – Rs. 17.50                              |
|                       | = Rs. 7.50 per unit.                              |

**(c) Fixed cost in Semi Variable Cost :**

|  |                       |
|--|-----------------------|
| Total semi variable cost   | = Rs. 1,80,000        |
| Less : Variable cost @ Rs. 3.75 per unit<br>(Rs. 3.75 x 32000 units) | = <u>Rs. 1,20,000</u> |
| Fixed cost in semi-variable cost                                     | = <u>Rs. 60,000</u>   |

**(d) Total Fixed cost upto 80% level :**

|  |                       |
|--|-----------------------|
| Fixed cost upto 80%                    | = Rs. 90,000          |
| Add : Fixed cost in Semi variable cost | = <u>Rs. 60,000</u>   |
| Total Fixed cost upto 80% level        | = <u>Rs. 1,50,000</u> |

**(e) Total Fixed cost above 80% level :**

|  |   |                     |
|--|---|---------------------|
| Fixed cost upto 80% Level              | = | Rs. 90,000          |
| Add : Fixed cost in Semi-variable cost | = | Rs. 60,000          |
| Add : Additional Fixed cost            | = | Rs. 20,000          |
| Total Fixed cost above 80% level       | = | <u>Rs. 1,70,000</u> |

**(f) No. of units produced at 80% level :**

|                       |   |  |
|-----------------------|---|--|
| Total Turnover        | = | Rs. 8,00,000                                 |
| Per unit              | = | Rs. 25                                       |
| No. of units produced | = | $\frac{8,00,000}{25} = 32,000 \text{ units}$ |

**(g) No. of units produced at 100% level :**

|                                     |   |  |
|-------------------------------------|---|--|
| No. of units produced at 80% level  | = | 32,000 units                               |
| No. of units produced at 100% level | = | $\frac{32,000}{80} = 40,000 \text{ units}$ |

**(h) Profit at 80% level of activity :**

|                     |   |  |
|---------------------|---|--|
| Profit              | = | Sales units x Contribution per unit – Fixed Cost                   |
|                     | = | $(32,000 \times \text{Rs. } 7.5) - \text{Rs. } 1,50,000$           |
|                     | = | $\text{Rs. } 2,40,000 - \text{Rs. } 1,50,000 = \text{Rs. } 90,000$ |
| Percentage to sales | = | $\frac{\text{Rs. } 90,000}{8,00,000} = 11.25\%$                    |

**(i) So upto desired profit Rs. 90,000**

|            |   |                 |
|------------|---|-----------------|
|            | = | 11.25% of sales |
| Fixed Cost | = | Rs. 1,50,000    |

**(1) Activity level at B E P :**

|                         |   |   |
|-------------------------|---|---|
| Activity level at B E P | = | $\frac{\text{Fixed Cost}}{\text{Contribution per unit}}$              |
|                         | = | $\frac{\text{Rs. } 1,50,000}{\text{Rs. } 7.5} = 20,000 \text{ units}$ |
| Activity level          | = | $\frac{20,000}{40,000} \times 100 = 50\% \text{ level}$               |

**(2) Number of units to be sold to earn a net income of 8% of sales :**

Suppose Sales Unit = X

**Equation :**

|                 |   |                                     |
|-----------------|---|-------------------------------------|
| Sales           | = | Variable Cost + Fixed Cost + Profit |
| 25 X            | = | $17.5 X + 1,50,000 + 2X$            |
|                 |   | (or)                                |
| 25 X            | = | $19.5 X + 1,50,000$                 |
| $25 X - 19.5 X$ | = | 1,50,000                            |

$$\begin{aligned}
 5.5 X &= 1,50,000 \\
 X &= \frac{1,50,000}{5.5} = 27,273 \text{ units}
 \end{aligned}$$

**(3) Activity level needed to earn a profit of Rs. 95,000 :**

The profit amount can be achieved at over 80% level, hence fixed cost will be Rs. 1,70,000

$$\begin{aligned}
 \text{Sales} &= \frac{\text{Fixed Cost} + \text{Desired Profit}}{\text{Contribution per unit}} \\
 &= \frac{1,70,000 + 95,000}{7.5} = 35,333 \text{ units} \\
 \text{Activity Level} &= \frac{\text{Sales}}{\text{No. of units produced at 100\% level}} \times 100 \\
 &= \frac{35,333}{40,000} \times 100 \\
 &= 88.33\%
 \end{aligned}$$

**(4) Selling price per unit required to bring down B E P to 40% activity level :**

$$\begin{aligned}
 40\% \text{ Activity level} &= 40\% \text{ of } 40,000 \\
 &= 40,000 \times \frac{40}{100} = 16,000 \text{ units}
 \end{aligned}$$

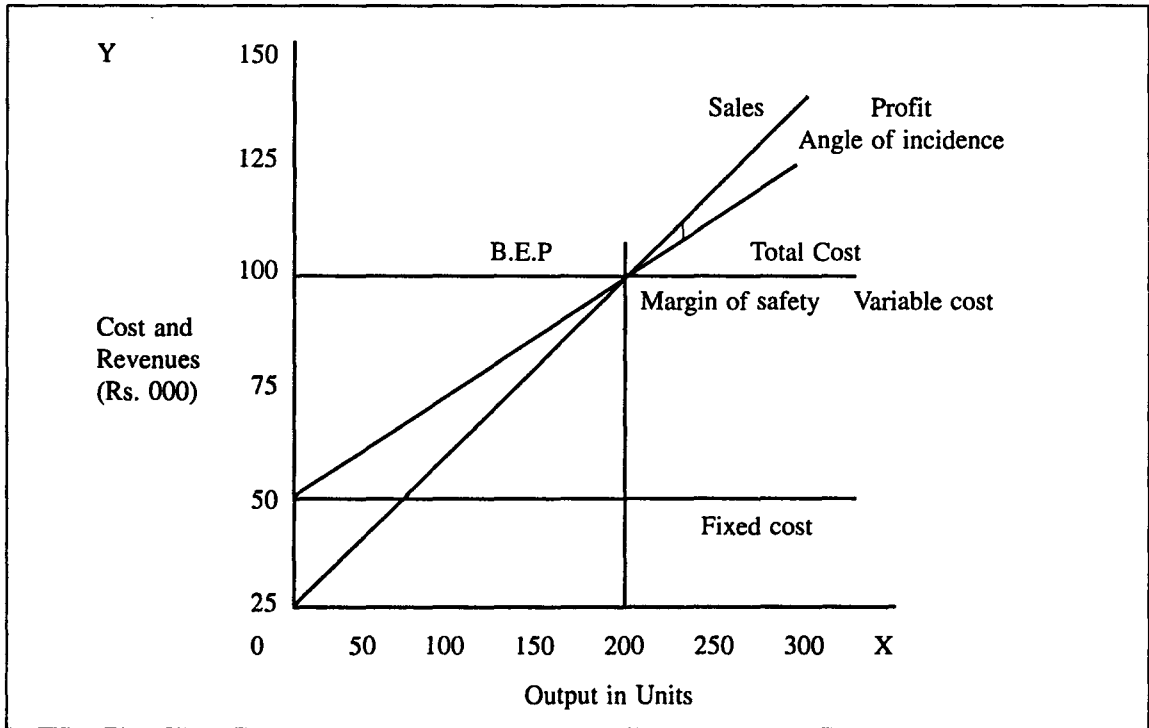
Selling price to Break-Even at the level

$$\begin{aligned}
 &= \frac{\text{Fixed Cost} + \text{Variable cost per unit}}{\text{Sales}} \\
 &= \frac{1,50,000}{16,000} + \text{Rs. } 17.50 \\
 &= \text{Rs. } 9.375 + \text{Rs. } 17.50 = \text{Rs. } 26.875 \\
 \left. \begin{array}{l} \text{Selling price per unit} \\ \text{required to bring down} \\ \text{B E P to 40\% activity level} \end{array} \right\} &= \text{Rs. } 26.875
 \end{aligned}$$

## I. Break-Even Chart

A break-even chart is a graphical presentation which indicates the relationship between cost, sales and profit. The chart depicts fixed costs, variable cost, break-even point, profit or loss, margin of safety and the angle of incidence. Such a chart not only indicates break-even point but also shows the estimated cost and estimated profit or loss at various level of activity. Break-even point is an important stage in the break-even chart which represents no profit no loss.

The following Break-Even Chart can explain more above the inter relationship between the costs, volume and profit :



From the above break-even chart, we can understand the following points :

- (1) Cost and sales revenue are represented on vertical axis, i.e., Y-axis.
- (2) Volume of production or output in units are plotted on horizontal axis, i.e., X-axis.
- (3) Fixed cost line is drawn parallel to X-axis.
- (4) Variable costs are drawn above the fixed cost line at different level of activity. The variable cost line is joined to fixed cost line at zero level of activity.
- (5) The sales line is plotted from the zero level, it represents sales revenue.
- (6) The point of intersection of total cost line and sales line is called the break-even point which means no profit no loss.
- (7) The margin of safety is the distance between the break-even point and total output produced.
- (8) The area below the break-even point represents the loss area as the total sales and less than the total cost.
- (9) The area above the break-even point represents profit area as the total sales more than the cost.
- (10) The sales line intersects the total cost line represents the angle of incidence. The large angle of incidence indicates a high rate of profit and vice versa.

## II. Cash Break-Even Point

In cash break-even chart, only cash fixed costs are considered. Non-cash items like depreciation etc. are excluded from the fixed costs for computation of break-even point. Cash Break-Even Chart depicts the level of output or sales at which the sales revenue will be equal to total cash outflow. It is computed as under :

$$\text{Cash Break-Even Point} = \frac{\text{Cash Fixed Costs}}{\text{Contribution per unit}}$$

### Illustration: 11

From the following information calculate the Cash Break-Even Point :

|                                     |              |
|-------------------------------------|--------------|
| Selling price per unit              | Rs. 60       |
| Variable cost per unit              | Rs. 40       |
| Fixed cost                          | Rs. 2,00,000 |
| Depreciation included in fixed cost | Rs. 50,000   |

### Solution:

$$\begin{aligned} \text{Cash Fixed Cost} &= \text{Rs. 2,00,000} - \text{Rs. 50,000} = \text{Rs. 1,50,000} \\ &= 60 - 40 = \text{Rs. 20} \\ \text{Cash Break-Even point in units} &= \frac{\text{Cash Fixed Cost}}{\text{Contribution per unit}} \\ &= \frac{1,50,000}{20} = 7,500 \text{ units} \end{aligned}$$

### Advantages of Break-Even Chart

- (1) It enables to determine the profit or loss at different levels of activities.
- (2) It is useful to measure the relationship between cost volume and profit.
- (3) It helps to determine the break-even units, i.e., output and sales volume.
- (4) It helps to measure the profitability of various products.
- (5) It facilitates most profitable product mix to be adopted.
- (6) It assists future planning and forecasting.
- (7) It enables to determine total cost, fixed cost and variable cost at different levels of activity.
- (8) This chart is very useful for effective cost control.

### Limitations of Break-Even Chart

- (1) It is based on number of assumptions which may not hold good.
- (2) Break-even charts are rarely of value in a multi-product situation.
- (3) A break-even chart does not take into consideration semi-variable cost, valuation of opening stock and closing stock.
- (4) Determination of selling price is based on many factors which will affect the constant selling price.
- (5) Capital employed, Government policy, Market environment etc. are the important aspects for managerial decisions. These aspects are not considered in break-even chart.

## Angle of Incidence

The angle formed by the sales line and the total cost line at the break-even point is known as Angle of Incidence. The angle of incidence is used to measure the profit earning capacity of a firm. A large angle of incidence indicates a high rate of profit and on the other hand a small angle of incidence means that a low rate of profit.

## Relationship between Angle of Incidence, Break-Even Sales and Margin of Safety Sales

- (1) When the Break-even sales are very low, with large angle of incidence, it indicates that the firm is enjoying business stability and in that case margin of safety sales will also be high.
- (2) When the break-even sales are low, but not very low with moderate angle of incidence, in that case though the business is stable, the profit earning rate is not very high as in the earlier case.
- (3) Contrary to the above when the break-even sales are high, the angle of incidence will be narrow with much lower margin of safety sales.

## QUESTIONS

1. What do you understand by Marginal Costing?
2. Define Marginal Costing Briefly explain the features of marginal costing.
3. What are the differences between Absorption costing and Marginal costing?
4. What is meant by Differential costing?
5. Compare and contrast Marginal costing and Differential costing.
6. What are the important decision making areas of Marginal costing?
7. Briefly explain the advantages and limitations of Marginal costing.
8. What do you understand by Cost Volume Profit Analysis?
9. Briefly explain the objectives of cost volume profit analysis.
10. Explain Marginal cost equation.
11. What is Contribution? How it is computed?
12. What do you understand by Break-Even Analysis?
13. Write short notes on :
  - (a) Profit Volume ratio. (b) Margin of Safety. (c) Break-Even chart. (d) Angle of Incidence.
14. Briefly explain the advantages and limitations of Break-Even Chart
15. Briefly explain the relationship between Angle of Incidence, Break-Even Sales and Margin of Safety.
16. From the following particulars, you are required to find out (a) Contribution (b) Break-even point in units (c) Margin of safety and (d) Profit
 

|                     |             |
|---------------------|-------------|
| Total Fixed cost    | Rs. 4,500   |
| Total Variable cost | Rs. 7,500   |
| Total Sales         | Rs. 15,000  |
| Units sold          | 5,000 units |

Also calculate the volume of sales to earn profit of Rs. 6,000

[Ans : (a) Contribution Rs. 7,500 (b) Break-even point in units Rs. 3,000 units (c) Margin of Safety Rs. 6,000 (d) Profit Rs. 3,000]
17. From the following data, calculate :
  - (a) P / V Ratio.
  - (b) Profit when sales are Rs. 40,000.
  - (c) New break-even point if selling price is reduced by 20%.

Fixed Expenses Rs. 8,000.  
Break-Even point Rs. 10,000.

[Ans : (a) Profit volume ratio 40%. (b) Profit when sales are Rs. 40,000 is Rs. 8,000.  
(c) New break-even point if selling price is reduced by 20% is Rs. 32,000.]
18. From the following particulars you are required to calculate (a) P / V ratio and (b) Break-even point :
 

Present sales Rs. 2,00,000  
Variable cost Rs. 1,20,000  
Fixed expenses Rs. 40,000

Ascertain the effect of 10% reduction of selling price on (a) P / V ratio and (b) Break-Even Point.  
Also calculate the sales required to maintain the profit at the present level.

[Ans : (a) P / V Ratio 40% ; New P / V Ratio = 33%.  
(a) Break-even point Rs. 1,00,000; New BEP = Rs. 1,20,000.

- (b) Sales required to maintain the profit at the present level.  
Present profit Rs. 20000. Required Sales Rs. 1,81,820.]
19. The following are the cost information in relation to the manufacture of a product :  
Selling price – Rs. 10 per unit  
Trade discount – 5% of selling price  
Material cost – Rs. 3 per unit  
Labour – Rs. 2 per unit  
**Overheads :**  
Fixed Rs. 10,000  
Variable 100% of labour cost  
Calculate :  
(a) B E P.  
(b) Profit if sales are 15% above break-even volume.  
[Ans : BEP – 4,000 units; Profits Rs. 1,500, Volume 4,600 units.]
20. Sales Price – Rs. 20 unit  
Variable manufacturing cost – Rs. 11 per unit.  
Variable selling cost – Rs. 3 per unit.  
Fixed factory overheads – Rs. 5,40,000 per year.  
Fixed selling costs – Rs. 2,52,000 per unit.  
**Calculate :**  
(a) BEP Volume and Value.  
(b) Sales required to earn a profit of Rs. 60,000.  
(c) Sales required to earn a profit of 10% of sales.  
[Ans : (a) BEP Volume – 1,32,000 units; Value – Rs. 26,40,000.  
(b) Sales – 1,42,000 units; Value – Rs. 28,40,000.  
(d) Sales – 1,98,000 units; Value – Rs. 39,60,000.  
(11,88,000; 3,96,000).]
21. From the following data, find out how many units should be sold to earn a net profit of 10% on sales.  
Selling price per unit Rs. 20  
Variable cost per unit Rs. 14  
Fixed cost (total) Rs. 7,92,000  
[Ans: Sales in Units 1,98,000]
22. A company estimates that next year it will earn a profit of Rs. 50,000. The budgeted fixed costs and sales are Rs. 2,50,000 and Rs. 9,93,000 respectively. Find out the break-even point for the company.  
[Ans: B.E.P in sales. Rs. 8,27,500]
23. Plant I produces a product which costs Rs. 3 per unit when produced in quantities of 10,000 Units and Rs. 2.50 per Unit when produced in quantities of 20,000 units. You are asked to estimate total fixed costs.  
[Ans: Fixed cost Rs. 10,000]
24. The following are the budgeted data of a company.
- |                | Rs.      |
|----------------|----------|
| Sales          | 6,00,000 |
| Variable costs | 3,00,000 |
| Fixed costs    | 1,80,000 |
- Find out the break-even point at  
(i) the budgeted data  
(ii) assuming 20% increase in variable cost.  
[Ans: Break-even point Rs. 3,60,000; New Break-even point at 20% increase in variable costs Rs. 4,50,000]
25. Calculate No. of Units to be sold to earn a profit of Rs. 60,000 a year
- |                             | Rs. 20 per unit       |
|-----------------------------|-----------------------|
| Variable manufacturing cost | Rs. 11 per unit       |
| Variable selling price      | Rs. 3 per unit        |
| Fixed factory overhead      | Rs. 5,40,000 per year |
| Fixed selling costs         | Rs. 2,52,000 per year |
- [Ans: No. of Units to be sold is 1,42,000 units]
26. Present production and sales : 8,000 units  
Selling price per unit Rs. 20  
Direct labour Rs. 2.50  
Variable overhead Rs 100% of direct labour cost  
Direct materials Rs. 5  
Fixed costs Rs. 40,000

Find out;

- (a) P/V Ratio
- (b) Sales required to break-even point and
- (c) Margin of safety

[Ans: P/V ratio 50% ; BEP Rs 80,000; Margin of safety Rs 80,000]

27. The P/V ratio of Gupta & Co. is 60% during 2003. Sales were Rs 1,50,000 and the fixed cost Rs 15,000. Calculate :

- (a) Total variable expenses
- (b) Total contribution
- (c) Profit and
- (d) Profit if sales are increased to Rs. 2,25,000

[Ans: a) Total variable cost Rs. 60,000; b) Total contribution Rs. 90,000

c) Profit Rs. 75,000; d) Profit Rs. 1,20,000]

28. The projected capacity of a plant, when sold, would return Rs. 70,000 in sales income to the company. The variable costs for this production volume were determined to be Rs. 30,000. The fixed costs are Rs. 20,000. Determine the following :

- (1) the break-even point of the business
- (2) the profit or loss to the business on sales of Rs. 49,000; Rs. 28,000
- (3) the amount of sales that will enable the business to earn a net profit of Rs. 28,000

[Ans: (1) break-even point Rs. 35,000;

(2) if sales of Rs. 49,000 the profit is Rs. 8,000; if sales of Rs. 28,000 the loss is Rs. 4,000

(3) the amount of sales Rs. 80,500]

29. From the following data, find out the break-even point; P/V ratio, and margin of safety ratio.

|                |           |      |
|----------------|-----------|------|
| Fixed costs    | 6,00,000  | 30%  |
| Variable costs | 12,00,000 | 60%  |
| Net profit     | 2,00,000  | 10%  |
| Sales          | 20,00,000 | 100% |

[Ans: P/V ratio 40%; BEP Rs 15,00,000; Margin of safety Ratio 25%]

30. A company budgets for a production of 1,50,000 units. The variable cost per unit is Rs. 14 and fixed cost is Rs. 2 per unit. The company fixes its selling price to fetch a profit of 15% on cost.

- (a) What is the break-even point?
- (b) What is the profit-volume ratio?
- (c) If it reduces its selling price by 5%, how the revised selling price affect the break-even point and the profit-volume ratio?
- (d) If a profit increase of 10% is desired more than the budget, what should be the sales at the reduced prices?

[Ans: (a) Break-even point (in Rs.) Rs. 12,54,549

(b) P/V ratio 23.91%

(c) New break-even point in units 86,207 units new P/V ratio 19.90% (d) Sales for desired profit Rs. 34,96,000]

31. The following information regarding the operations of 2003 has been made available from the records of the AAA corporation.

|   |              |
|---|--------------|
| Sales                                     | Rs. 1,00,000 |
| Direct materials used                     | 40,000       |
| Direct labour                             | 15,000       |
| Fixed manufacturing overheads             | 20,000       |
| Fixed selling and administrative expenses | 10,000       |
| Gross profit                              | 20,000       |
| Net loss                                  | 5,000        |

There are no opening or closing inventories. It is required to calculate :

- (1) Variable selling and administrative expenses
- (2) Contribution Margin in rupees
- (3) Variable factory overhead
- (4) Break even point in rupee sales
- (5) Factory cost of goods sold

[Ans: Variable factory overheads Rs. 5,000; variable selling & administrative expenses Rs. 15,000; Contribution Margin Rs. 25,000; Break-even point Rs. 1,20,000; Factory cost of goods sold Rs. 80,000]